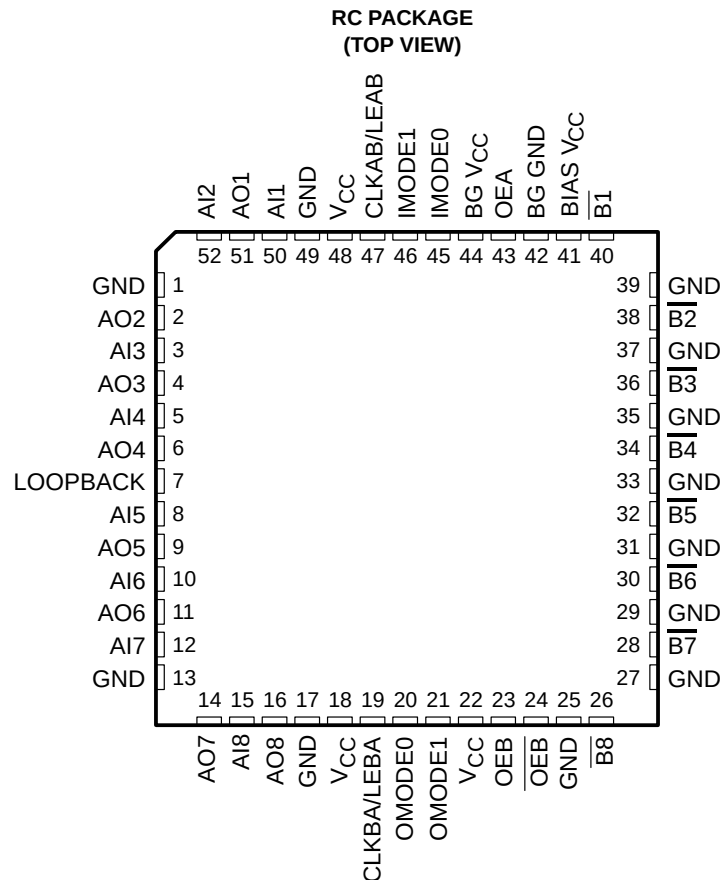


# SN74FB2033K 8-BIT TTL/BTL REGISTERED TRANSCEIVER

SCBS472G – MAY 1994 – REVISED SEPTEMBER 2001

- Compatible With IEEE Std 1194.1-1991 (BTL)
- TTL A Port, Backplane Transceiver Logic (BTL)  $\bar{B}$  Port
- Open-Collector  $\bar{B}$ -Port Outputs Sink 100 mA
- BIAS  $V_{CC}$  Pin Minimizes Signal Distortion During Live Insertion/Withdrawal
- High-Impedance State During Power Up and Power Down
- $\bar{B}$ -Port Biasing Network Preconditions the Connector and PC Trace to the BTL High-Level Voltage
- TTL-Input Structures Incorporate Active Clamping Networks to Aid in Line Termination



## description

The SN74FB2033K is an 8-bit transceiver featuring a split input (AI) and output (AO) bus on the TTL-level A port. The common I/O, open-collector  $\bar{B}$  port operates at backplane transceiver logic (BTL) signal levels. The SN74FB2033K is specifically designed to be compatible with IEEE Std 1194.1-1991.

The logic element for data flow in each direction is configured by two mode inputs (IMODE1 and IMODE0 for B-to-A, OMODE1 and OMODE0 for A-to-B) as a buffer, a D-type flip-flop, or a D-type latch. When configured in the buffer mode, the inverted input data appears at the output port. In the flip-flop mode, data is stored on the rising edge of the appropriate clock input (CLKAB/LEAB or CLKBA/LEBA). In the latch mode, the clock inputs serve as active-high transparent latch enables.



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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description (continued)

Data flow in the B-to-A direction, regardless of the logic element selected, is further controlled by the LOOPBACK input. When LOOPBACK is low,  $\overline{B}$ -port data is the B-to-A input. When LOOPBACK is high, the output of the selected A-to-B logic element (before inversion) is the B-to-A input.

The AO port-enable/-disable control is provided by OEA. When OEA is low or when  $V_{CC}$  is less than 2.5 V, the AO port is in the high-impedance state. When OEA is high, the AO port is active (high or low logic levels).

The  $\overline{B}$  port is controlled by OEB and  $\overline{OEB}$ . If OEB is low, or  $\overline{OEB}$  is high, or when  $V_{CC}$  is less than 2.5 V, the  $\overline{B}$  port is inactive. If OEB is high and  $\overline{OEB}$  is low, the  $\overline{B}$  port is active.

BG  $V_{CC}$  and BG GND are the bias-generator reference inputs.

The A-to-B and B-to-A logic elements are active, regardless of the state of their associated outputs. The logic elements can enter new data (in flip-flop and latch modes) or retain previously stored data while the associated outputs are in the high-impedance (AO port) or inactive ( $\overline{B}$  port) states.

Output clamps are provided on the BTL outputs to reduce switching noise. One clamp reduces inductive ringing effects on  $V_{OH}$  during a low-to-high transition. The other clamps out ringing below the BTL  $V_{OL}$  voltage of 0.75 V. Both of these clamps are active only during ac switching and do not affect the BTL outputs during steady-state conditions.

BIAS  $V_{CC}$  establishes a voltage between 1.62 V and 2.1 V on the BTL outputs when  $V_{CC}$  is not connected.

ORDERING INFORMATION

| TA          | PACKAGE† |      | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|-------------|----------|------|-----------------------|------------------|
| 0°C to 70°C | QFP – RC | Tube | SN74FB2033KRC         | FB2033K          |

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

### Function Tables

| FUNCTION |     |                         |        |        |        |        |          | FUNCTION/MODE                                             |
|----------|-----|-------------------------|--------|--------|--------|--------|----------|-----------------------------------------------------------|
| INPUTS   |     |                         |        |        |        |        |          |                                                           |
| OEA      | OEB | $\overline{\text{OEB}}$ | OMODE1 | OMODE0 | IMODE1 | IMODE0 | LOOPBACK |                                                           |
| L        | L   | X                       | X      | X      | X      | X      | X        | Isolation                                                 |
| L        | X   | H                       | X      | X      | X      | X      | X        |                                                           |
| X        | H   | L                       | L      | L      | X      | X      | X        | AI to $\overline{\text{B}}$ , buffer mode                 |
| X        | H   | L                       | L      | H      | X      | X      | X        | AI to $\overline{\text{B}}$ , flip-flop mode              |
| X        | H   | L                       | H      | X      | X      | X      | X        | AI to $\overline{\text{B}}$ , latch mode                  |
| H        | L   | X                       | X      | X      | L      | L      | L        | $\overline{\text{B}}$ to AO, buffer mode                  |
| H        | X   | H                       | X      | X      | L      | L      | L        |                                                           |
| H        | L   | X                       | X      | X      | L      | H      | L        | $\overline{\text{B}}$ to AO, flip-flop mode               |
| H        | X   | H                       | X      | X      | L      | H      | L        |                                                           |
| H        | L   | X                       | X      | X      | H      | X      | L        | $\overline{\text{B}}$ to AO, latch mode                   |
| H        | X   | H                       | X      | X      | H      | X      | L        |                                                           |
| H        | L   | X                       | X      | X      | L      | L      | H        | AI to AO, buffer mode                                     |
| H        | X   | H                       | X      | X      | L      | L      | H        |                                                           |
| H        | L   | X                       | X      | X      | L      | H      | H        | AI to AO, flip-flop mode                                  |
| H        | X   | H                       | X      | X      | L      | H      | H        |                                                           |
| H        | L   | X                       | X      | X      | H      | X      | H        | AI to AO, latch mode                                      |
| H        | X   | H                       | X      | X      | H      | X      | H        |                                                           |
| H        | H   | L                       | X      | X      | X      | X      | L        | AI to $\overline{\text{B}}$ , $\overline{\text{B}}$ to AO |

### ENABLE/DISABLE

| INPUTS |     |                         | OUTPUTS      |   |
|--------|-----|-------------------------|--------------|---|
| OEA    | OEB | $\overline{\text{OEB}}$ | AO           | B |
| L      | X   | X                       | Hi Z         |   |
| H      | X   | X                       | Active       |   |
| X      | L   | L                       | Inactive (H) |   |
| X      | L   | H                       | Inactive (H) |   |
| X      | H   | L                       | Active       |   |
| X      | H   | H                       | Inactive (H) |   |

### BUFFER

| INPUT | OUTPUT |
|-------|--------|
| L     | H      |
| H     | L      |

### LATCH

| INPUTS |      | OUTPUT         |
|--------|------|----------------|
| CLK/LE | DATA |                |
| H      | L    | H              |
| H      | H    | L              |
| L      | X    | Q <sub>0</sub> |

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Function Tables (Continued)

LOOPBACK

| LOOPBACK | $Q^\dagger$         |
|----------|---------------------|
| L        | $\overline{B}$ port |
| H        | Point $P^\ddagger$  |

$^\dagger$  Q is the input to the B-to-A logic element.

$^\ddagger$  P is the output of the A-to-B logic element (see functional block diagram).

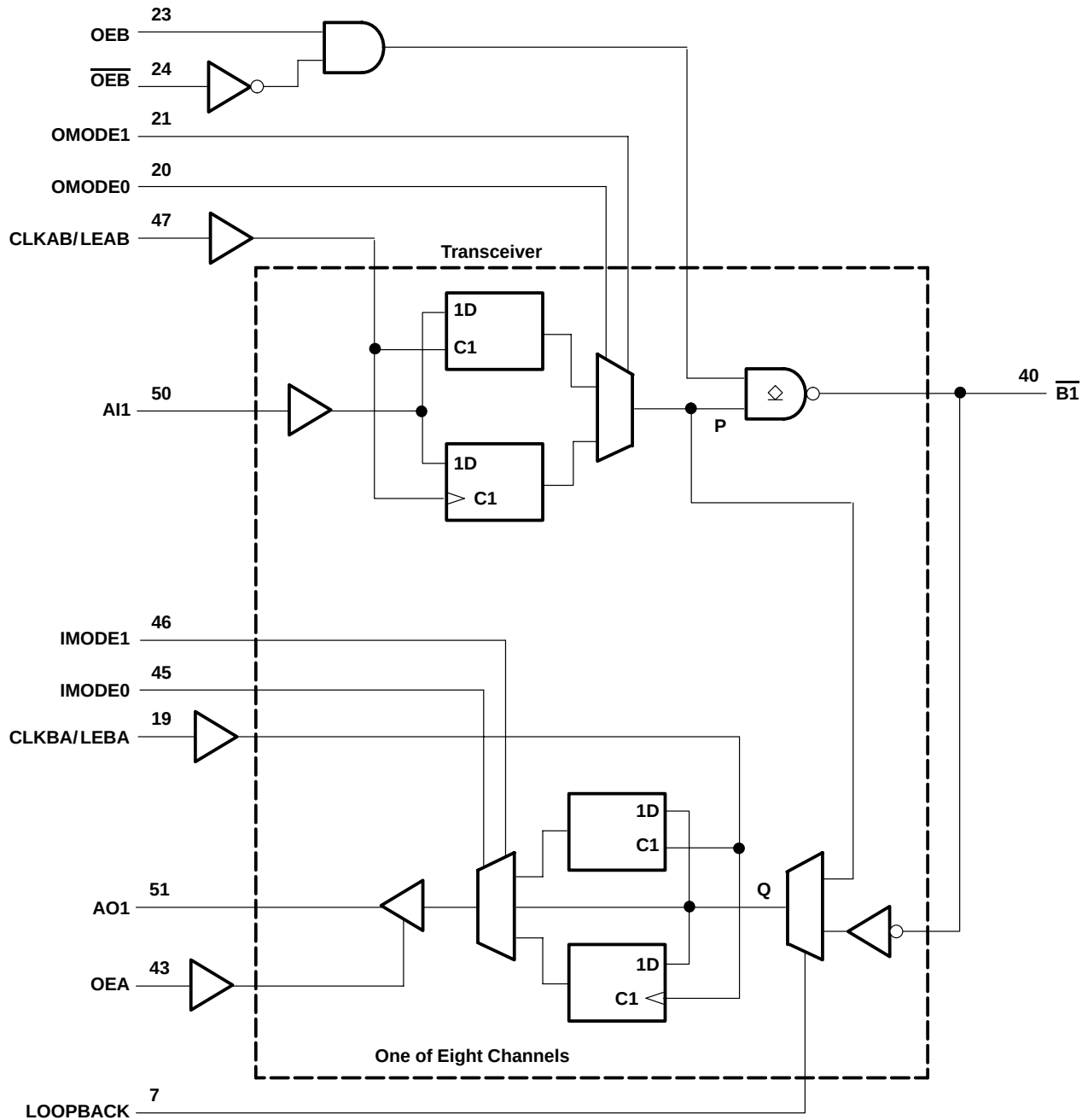
SELECT

| INPUTS |       | SELECTED-LOGIC ELEMENT |
|--------|-------|------------------------|
| MODE1  | MODE0 |                        |
| L      | L     | Buffer                 |
| L      | H     | Flip-flop              |
| H      | X     | Latch                  |

FLIP-FLOP

| INPUTS     |      | OUTPUT |
|------------|------|--------|
| CLK/LE     | DATA |        |
| L          | X    | $Q_0$  |
| $\uparrow$ | L    | H      |
| $\uparrow$ | H    | L      |

functional block diagram



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### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

|                                                                                 |                    |
|---------------------------------------------------------------------------------|--------------------|
| Supply voltage range, $V_{CC}$                                                  | –0.5 V to 7 V      |
| Voltage range applied to any B output in the disabled or power-off state, $V_O$ | –0.5 V to 3.5 V    |
| Voltage range applied to any output in the high state, $V_O$ : A port           | –0.5 V to $V_{CC}$ |
| Input voltage range, $V_I$ : Except $\overline{B}$ port                         | –1.2 V to 7 V      |
| $\overline{B}$ port                                                             | –1.2 V to 3.5 V    |
| Input clamp current, $I_{IK}$ : Except $\overline{B}$ port                      | –40 mA             |
| $\overline{B}$ port                                                             | –18 mA             |
| Current applied to any single output in the low state, $I_O$ : A port           | 48 mA              |
| $\overline{B}$ port                                                             | 200 mA             |
| Package thermal impedance, $\theta_{JA}$ (see Note 1)                           | 44°C/W             |
| Storage temperature range, $T_{stg}$                                            | –65°C to 150°C     |

<sup>†</sup> Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: The package thermal impedance is calculated in accordance with JESD 51-7.

### recommended operating conditions (see Note 2)

|                        |                                    | MIN                        | NOM | MAX  | UNIT |
|------------------------|------------------------------------|----------------------------|-----|------|------|
| $V_{CC}$ , BG $V_{CC}$ | Supply voltage                     | 4.75                       | 5   | 5.25 | V    |
| BIAS $V_{CC}$          | Supply voltage                     | 4.5                        | 5   | 5.5  | V    |
| $V_{IH}$               | High-level input voltage           | $\overline{B}$ port        |     | 1.62 | V    |
|                        |                                    | Except $\overline{B}$ port |     | 2    |      |
| $V_{IL}$               | Low-level input voltage            | $\overline{B}$ port        |     | 0.75 | V    |
|                        |                                    | Except $\overline{B}$ port |     | 0.8  |      |
| $I_{OH}$               | High-level output current          | AO port                    |     | –3   | mA   |
| $I_{OL}$               | Low-level output current           | AO port                    |     | 24   | mA   |
|                        |                                    | $\overline{B}$ port        |     | 100  |      |
| $\Delta t/\Delta v$    | Input transition rise or fall rate | Except $\overline{B}$ port |     | 10   | ns/V |
| $T_A$                  | Operating free-air temperature     | 0                          |     | 70   | °C   |

NOTE 2: To ensure proper device operation, all unused inputs must be terminated as follows: A and control inputs to  $V_{CC}$ (5 V) or GND, and B inputs to GND only. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

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## 8-BIT TTL/BTL REGISTERED TRANSCEIVER

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### electrical characteristics over recommended operating free-air temperature range

| PARAMETER     |                                                 | TEST CONDITIONS                              |                                       | MIN  | TYP <sup>†</sup> | MAX            | UNIT          |
|---------------|-------------------------------------------------|----------------------------------------------|---------------------------------------|------|------------------|----------------|---------------|
| $V_{IK}$      | $\overline{B}$ port                             | $V_{CC} = 4.75\text{ V}$ ,                   | $I_I = -18\text{ mA}$                 |      |                  | -1.2           | V             |
|               | Except $\overline{B}$ port                      | $V_{CC} = 4.75\text{ V}$ ,                   | $I_I = -40\text{ mA}$                 |      |                  | -0.5           |               |
| $V_{OH}$      | AO port                                         | $V_{CC} = 4.75\text{ V to } 5.25\text{ V}$ , | $I_{OH} = -10\text{ }\mu\text{A}$     |      |                  | $V_{CC} - 1.1$ | V             |
|               |                                                 | $V_{CC} = 4.75\text{ V}$                     | $I_{OH} = -3\text{ mA}$               | 2.5  | 2.85             | 3.4            |               |
|               |                                                 |                                              | $I_{OH} = -32\text{ mA}$              | 2    |                  |                |               |
| $V_{OL}$      | AO port                                         | $V_{CC} = 4.75\text{ V}$                     | $I_{OL} = 20\text{ mA}$               |      | 0.33             | 0.5            | V             |
|               |                                                 |                                              | $I_{OL} = 55\text{ mA}$               |      |                  | 0.8            |               |
|               | $\overline{B}$ port                             | $V_{CC} = 4.75\text{ V}$                     | $I_{OL} = 100\text{ mA}$              | 0.75 |                  | 1.1            |               |
|               |                                                 |                                              | $I_{OL} = 4\text{ mA}$                | 0.5  |                  |                |               |
|               |                                                 |                                              |                                       |      |                  |                |               |
| $I_I$         | Except $\overline{B}$ port                      | $V_{CC} = 0$ ,                               | $V_I = 5.25\text{ V}$                 |      |                  | 100            | $\mu\text{A}$ |
| $I_{IH}$      | Except $\overline{B}$ port                      | $V_{CC} = 5.25\text{ V}$ ,                   | $V_I = 2.7\text{ V}$                  |      |                  | 50             | $\mu\text{A}$ |
|               | $\overline{B}$ port <sup>‡</sup>                | $V_{CC} = 0\text{ to } 5.25\text{ V}$ ,      | $V_I = 2.1\text{ V}$                  |      |                  | 100            |               |
| $I_{IL}$      | Except $\overline{B}$ port                      | $V_{CC} = 5.25\text{ V}$ ,                   | $V_I = 0.5\text{ V}$                  |      |                  | -50            | $\mu\text{A}$ |
|               | $\overline{B}$ port <sup>‡</sup>                | $V_{CC} = 5.25\text{ V}$ ,                   | $V_I = 0.75\text{ V}$                 |      |                  | -100           |               |
| $I_{OH}$      | $\overline{B}$ port                             | $V_{CC} = 0\text{ to } 5.25\text{ V}$ ,      | $V_O = 2.1\text{ V}$                  |      |                  | 100            | $\mu\text{A}$ |
| $I_{OZH}$     | AO port                                         | $V_{CC} = 2.1\text{ V to } 5.25\text{ V}$ ,  | $V_O = 2.7\text{ V}$                  |      |                  | 50             | $\mu\text{A}$ |
| $I_{OZL}$     | AO port                                         | $V_{CC} = 2.1\text{ V to } 5.25\text{ V}$ ,  | $V_O = 0.5\text{ V}$                  |      |                  | -50            | $\mu\text{A}$ |
| $I_{OZPU}$    | A port                                          | $V_{CC} = 0\text{ to } 2.1\text{ V}$ ,       | $V_O = 0.5\text{ V to } 2.7\text{ V}$ |      |                  | 50             | $\mu\text{A}$ |
| $I_{OZPD}$    | A port                                          | $V_{CC} = 2.1\text{ V to } 0$ ,              | $V_O = 0.5\text{ V to } 2.7\text{ V}$ |      |                  | -50            | $\mu\text{A}$ |
| $I_{OS}^{\S}$ | AO port                                         | $V_{CC} = 5.25\text{ V}$ ,                   | $V_O = 0$                             | -40  | -80              | -150           | mA            |
| $I_{CC}$      | All outputs on                                  | $V_{CC} = 5.25\text{ V}$ ,                   | $I_O = 0$                             |      | 45               | 70             | mA            |
| $C_i$         | AI port and control inputs                      | $V_I = 0.5\text{ V or } 2.5\text{ V}$        |                                       |      | 5                |                | pF            |
| $C_O$         | AO port                                         | $V_O = 0.5\text{ V or } 2.5\text{ V}$        |                                       |      | 5                |                | pF            |
| $C_{io}$      | $\overline{B}$ port<br>per IEEE Std 1194.1-1991 | $V_{CC} = 0\text{ to } 4.75\text{ V}$        |                                       |      |                  | 6              | pF            |
|               |                                                 | $V_{CC} = 4.75\text{ V to } 5.25\text{ V}$   |                                       |      |                  | 6              |               |

<sup>†</sup> All typical values are at  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$

<sup>‡</sup> For I/O ports, the parameters  $I_{IH}$  and  $I_{IL}$  include the off-state output current.

<sup>§</sup> Not more than one output should be shorted at a time, and the duration of the short circuit should not exceed one second.

### live-insertion characteristics over recommended operating free-air temperature range (see Note 3)

| PARAMETER                 |                     | TEST CONDITIONS                              |                                                                                 | MIN  | MAX | UNIT          |
|---------------------------|---------------------|----------------------------------------------|---------------------------------------------------------------------------------|------|-----|---------------|
| $I_{CC}$ (BIAS $V_{CC}$ ) |                     | $V_{CC} = 0\text{ to } 4.75\text{ V}$ ,      | $V_B = 0\text{ to } 2\text{ V}$ , BIAS $V_{CC} = 4.5\text{ V to } 5.5\text{ V}$ |      | 1.2 | mA            |
|                           |                     | $V_{CC} = 4.75\text{ V to } 5.25\text{ V}$ , | $V_B = 0\text{ to } 2\text{ V}$ , BIAS $V_{CC} = 4.5\text{ V to } 5.5\text{ V}$ |      | 10  | $\mu\text{A}$ |
| $V_O$                     | $\overline{B}$ port | $V_{CC} = 0$ ,                               | BIAS $V_{CC} = 5\text{ V}$                                                      | 1.62 | 2.1 | V             |
| $I_O$                     | $\overline{B}$ port | $V_{CC} = 0$ ,                               | $V_B = 1\text{ V}$ , $V_I$ (BIAS $V_{CC}$ ) = $4.75\text{ V to } 5.25\text{ V}$ | -1   |     | $\mu\text{A}$ |
|                           |                     | $V_{CC} = 0\text{ to } 5.25\text{ V}$ ,      | OEB = $0\text{ to } 0.8\text{ V}$                                               |      | 100 |               |
|                           |                     | $V_{CC} = 0\text{ to } 2.2\text{ V}$ ,       | OEB = $0\text{ to } 5\text{ V}$                                                 |      | 100 |               |

NOTE 3: Power-up sequence is GND, BIAS  $V_{CC}$ ,  $V_{CC}$ .

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timing requirements over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 2)

|                                                                             | $V_{CC} = 5\text{ V}$ ,<br>$T_A = 25^\circ\text{C}$ |     | MIN | MAX | UNIT |
|-----------------------------------------------------------------------------|-----------------------------------------------------|-----|-----|-----|------|
|                                                                             | MIN                                                 | MAX |     |     |      |
| $f_{\text{clock}}$ Clock frequency                                          | 0                                                   | 150 | 0   | 150 | MHz  |
| $t_w$ Pulse duration, CLKAB/LEAB or CLKBA/LEBA                              | 3.3                                                 |     | 3.3 |     | ns   |
| $t_{\text{su}}$ Setup time, data before CLKAB/LEAB or CLKBA/LEBA $\uparrow$ | 2.7                                                 |     | 2.7 |     | ns   |
| $t_h$ Hold time, data after CLKAB/LEAB or CLKBA/LEBA $\uparrow$             | 0.7                                                 |     | 0.7 |     | ns   |



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switching characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 2)

| PARAMETER                                  | FROM<br>(INPUT)                                | TO<br>(OUTPUT) | V <sub>CC</sub> = 5 V,<br>T <sub>A</sub> = 25°C |     |     | MIN | MAX | UNIT |
|--------------------------------------------|------------------------------------------------|----------------|-------------------------------------------------|-----|-----|-----|-----|------|
|                                            |                                                |                | MIN                                             | TYP | MAX |     |     |      |
| f <sub>max</sub>                           |                                                |                | 150                                             |     |     | 150 |     | MHz  |
| t <sub>PLH</sub>                           | AI (through mode)                              | $\overline{B}$ | 2.8                                             | 5.1 | 6.8 | 2.8 | 8.1 | ns   |
| t <sub>PHL</sub>                           |                                                |                | 2.5                                             | 4.2 | 5.7 | 2.5 | 6.1 |      |
| t <sub>PLH</sub>                           | $\overline{B}$ (through mode)                  | AO             | 3.1                                             | 4.3 | 5.1 | 2.2 | 6.6 | ns   |
| t <sub>PHL</sub>                           |                                                |                | 3.1                                             | 4.2 | 5.1 | 2.6 | 6   |      |
| t <sub>PLH</sub>                           | AI (transparent)                               | $\overline{B}$ | 2.8                                             | 5.1 | 6.8 | 2.8 | 8.1 | ns   |
| t <sub>PHL</sub>                           |                                                |                | 2.6                                             | 4.2 | 5.7 | 2.6 | 6.1 |      |
| t <sub>PLH</sub>                           | $\overline{B}$ (transparent)                   | AO             | 2.2                                             | 4.3 | 6   | 2.2 | 6.6 | ns   |
| t <sub>PHL</sub>                           |                                                |                | 2.5                                             | 4.2 | 5.6 | 2.5 | 6   |      |
| t <sub>PLH</sub>                           | OEB                                            | $\overline{B}$ | 2.7                                             | 5.1 | 6.8 | 2.7 | 8.3 | ns   |
| t <sub>PHL</sub>                           |                                                |                | 2.4                                             | 4.2 | 5.7 | 2.4 | 6.1 |      |
| t <sub>PLH</sub>                           | $\overline{OEB}$                               | $\overline{B}$ | 2.5                                             | 4.8 | 6.4 | 2.5 | 7.7 | ns   |
| t <sub>PHL</sub>                           |                                                |                | 2.5                                             | 4.3 | 5.9 | 2.5 | 6.4 |      |
| t <sub>PZH</sub>                           | OEA                                            | AO             | 1.6                                             | 3.6 | 5.1 | 1.6 | 5.6 | ns   |
| t <sub>PZL</sub>                           |                                                |                | 2.3                                             | 4.3 | 5.7 | 2.3 | 6   |      |
| t <sub>PHZ</sub>                           | OEA                                            | AO             | 1.7                                             | 4   | 5.5 | 1.7 | 5.9 | ns   |
| t <sub>PLZ</sub>                           |                                                |                | 1.2                                             | 2.9 | 4.4 | 1.2 | 4.7 |      |
| t <sub>PLH</sub>                           | CLKAB/LEAB                                     | $\overline{B}$ | 5.2                                             | 6.5 | 7.8 | 3.7 | 9.9 | ns   |
| t <sub>PHL</sub>                           |                                                |                | 3.8                                             | 5.4 | 7.1 | 3.4 | 7.7 |      |
| t <sub>PLH</sub>                           | CLKBA/LEBA                                     | AO             | 1.7                                             | 3.8 | 5.5 | 1.7 | 5.9 | ns   |
| t <sub>PHL</sub>                           |                                                |                | 1.8                                             | 3.6 | 5.1 | 1.8 | 5.5 |      |
| t <sub>PLH</sub>                           | OMODE                                          | $\overline{B}$ | 2.9                                             | 6.6 | 8.4 | 2.9 | 10  | ns   |
| t <sub>PHL</sub>                           |                                                |                | 3                                               | 5.7 | 7.5 | 3   | 8.3 |      |
| t <sub>PLH</sub>                           | IMODE                                          | AO             | 1.4                                             | 4.1 | 5.8 | 1.4 | 6.4 | ns   |
| t <sub>PHL</sub>                           |                                                |                | 1.9                                             | 4.2 | 5.7 | 1.9 | 5.9 |      |
| t <sub>PLH</sub>                           | LOOPBACK                                       | AO             | 2                                               | 5.2 | 7.3 | 2   | 8.2 | ns   |
| t <sub>PHL</sub>                           |                                                |                | 2.6                                             | 4.8 | 6.3 | 2.6 | 6.4 |      |
| t <sub>PLH</sub>                           | AI                                             | AO             | 1.7                                             | 3.9 | 5.6 | 1.7 | 6.1 | ns   |
| t <sub>PHL</sub>                           |                                                |                | 2.2                                             | 4.3 | 5.7 | 2.2 | 5.9 |      |
| t <sub>r</sub>                             | Rise time, 1.3 V to 1.8 V, $\overline{B}$ port |                | 1.8                                             | 2.5 | 3.8 | 1.7 | 4   | ns   |
| t <sub>f</sub>                             | Fall time, 1.8 V to 1.3 V, $\overline{B}$ port |                | 1.7                                             | 2.5 | 3.8 | 1.5 | 4   |      |
| t <sub>r</sub>                             | Rise time, 10% to 90%, AO                      |                | 2.5                                             | 3.4 | 4.8 | 2   | 5   | ns   |
| t <sub>f</sub>                             | Fall time, 90% to 10%, AO                      |                | 1.5                                             | 2.5 | 3.8 | 1   | 5   |      |
| $\overline{B}$ -port input pulse rejection |                                                |                |                                                 |     |     | 1   |     | ns   |

### output-voltage characteristics

| PARAMETER        |                                                            |                     | TEST CONDITIONS          | MIN  | MAX | UNIT |
|------------------|------------------------------------------------------------|---------------------|--------------------------|------|-----|------|
| V <sub>OHP</sub> | Peak output voltage during turnoff of 100 mA into 40 nH    | $\overline{B}$ port | See Figure 1             |      | 3   | V    |
| V <sub>OHV</sub> | Minimum output voltage during turnoff of 100 mA into 40 nH | $\overline{B}$ port | See Figure 1             | 1.62 |     | V    |
| V <sub>OLV</sub> | Minimum output voltage during high-to-low switch           | $\overline{B}$ port | I <sub>OL</sub> = -50 mA | 0.3  |     | V    |



# SN74FB2033K

## 8-BIT TTL/BTL REGISTERED TRANSCEIVER

SCBS472G – MAY 1994 – REVISED SEPTEMBER 2001

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### PARAMETER MEASUREMENT INFORMATION

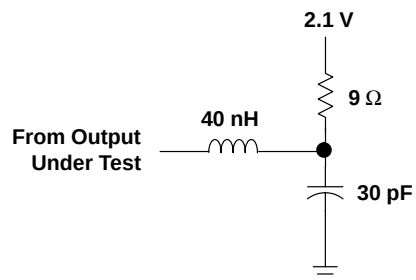
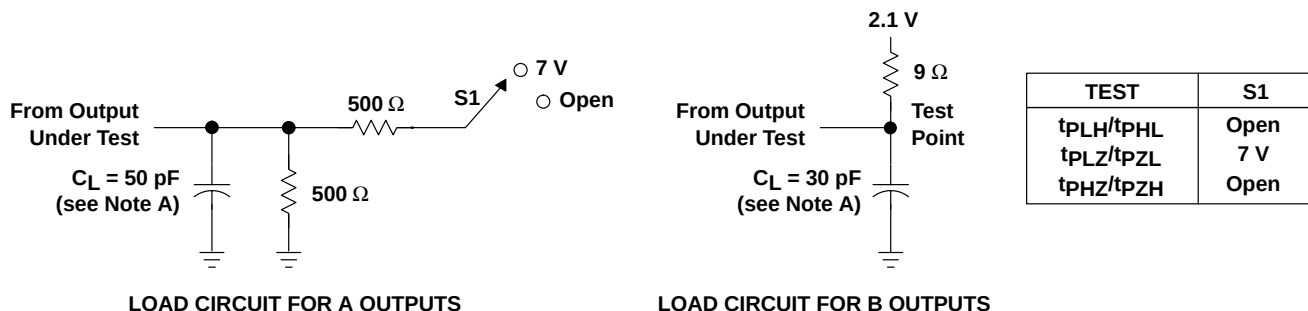


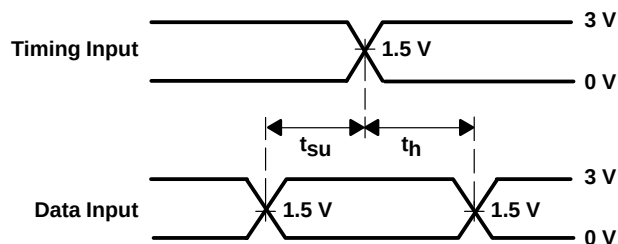
Figure 1. Load Circuit for  $V_{OHP}$  and  $V_{OHV}$

## PARAMETER MEASUREMENT INFORMATION

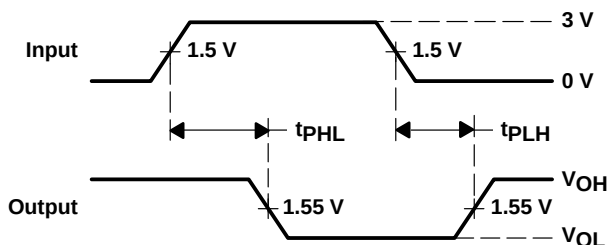


LOAD CIRCUIT FOR A OUTPUTS

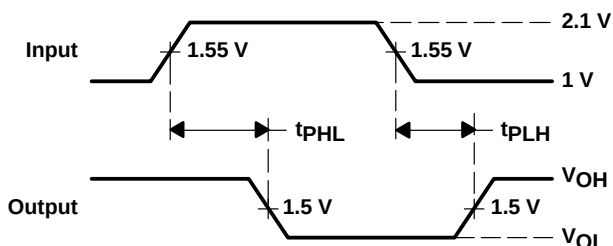
LOAD CIRCUIT FOR B OUTPUTS



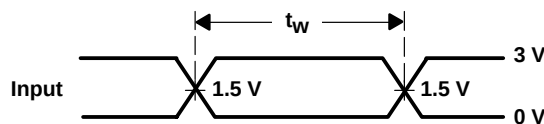
VOLTAGE WAVEFORMS  
SETUP AND HOLD TIMES



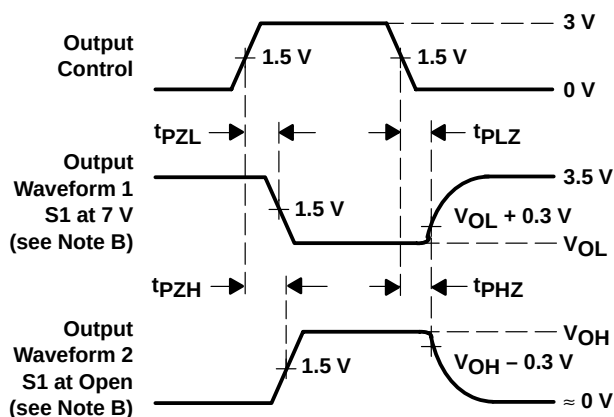
VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES (A TO B)



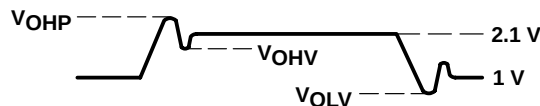
VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES (B TO A)



VOLTAGE WAVEFORMS  
PULSE DURATION



VOLTAGE WAVEFORMS  
ENABLE AND DISABLE TIMES (A PORT)



VOLTAGE WAVEFORMS

- NOTES: A.  $C_L$  includes probe and jig capacitance.  
B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.  
C. All input pulses are supplied by generators having the following characteristics: TTL inputs:  $PRR \leq 10$  MHz,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5$  ns,  $t_f \leq 2.5$  ns; BTL inputs:  $PRR \leq 10$  MHz,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5$  ns,  $t_f \leq 2.5$  ns.  
D. The outputs are measured one at a time with one transition per measurement.

Figure 2. Load Circuit and Voltage Waveforms

## PACKAGING INFORMATION

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| SN74FB2033KRC    | ACTIVE                | QFP          | RC              | 52   | 96          | TBD                     | CU SNPB          | Level-2-240C-1YR             |
| SN74FB2033KRRCR  | ACTIVE                | QFP          | RC              | 52   | 500         | TBD                     | CU SNPB          | Level-2-240C-1YR             |

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBsolete:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

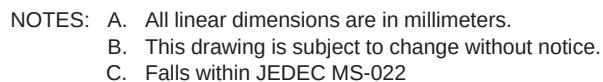
**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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